GOLDEN RULE
MADE
PLAIN and EASIER
BY
A short METHOD,
Different from
That which is commonly found
In BOOKS of

Arithmetick.

The Second Edition, with Additions.

LONDON;
First Printed 1660, and now Reprinted by J. C.
for *William Crook* at the figne of the Green
Dragon without *Temple-bar*. 1675.

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To the Reader.

THe Grounds of Arithmetick (namely, Numeration, Addition, Substraction, ultiplication, and Division) eing well enough taught by every riter, you may make use of such f them as you like best. But having observed that the first and ast of all the Rules of that Science, (namely the Golden Rule) by many thought hard, by reason f the breaking of it into two ules, called Direct and Inverse, hich some Learners say they cannot easily comprehend, nor, when a Question is propounded, know by hich of these Rules to work the olution of it; For the taking away of this discouragement, I have ought fit to recommend to you a ort and general way, by which all

Questions answerable by this Ru[le] may readily be wrought, witho[ut] any consideration at all of that di[-]stinction.

As for the derivation of it fro[m] the Elements of Euclide, *I hav[e] added it for their sakes, who sha[ll] think it worth their pains to ma[ke] discovery of the Fountain, an[d] know the reason of this Nob[le] Rule.*

If what I have done be of any u[se] and benefit to you, you will certain[-]ly accept of it, and I shall attai[n] the end for which I publish it.

C. H.

The Additions to this Impressio[n] are at the end, marked in th[e] Margent thus “.

The Golden Rule.

THE GOLDEN RULE, so called for its great use and excellencie above all other Rules of *Arithmetick*, is also called THE RULE OF THREE; because by the help of Three known Numbers, it discovers to us a Fourth unknown.

The Three known Numbers are always (saving that it may be otherwise in the Compound Rule) of two different *Denominations*, namely, two of them of one Denomination, and the third of the other Denomination.

Every Proposition which is to be resolved by this *Golden Rule* consists of two parts; First a *Supposition*, Secondly a *Question* or *Demand*.

In the Supposition there are as many Denominations as in the whole Proposition, and to every Denomination one Number.

The Question also contains all the Denominations, but one of them wants the Number belonging to it. And this is the unknown or required Number.

For the finding of this Number, two of the known Numbers are to be multiplied together, and the product to be divided by the third. He therefore that would make use of this *Golden Rule*, must be able to multiply and divide, and know which of the Three Numbers to take for his Divisor.

Now this Divisor is always one of the two Numbers which are of one Denomination. It will be best therefore, first to order the Three Numbers according to their Denominations; and then to consider whether the Number required be greater or less than the Number given of the same Denomination. For as soon as this is known (and the knowledge hereof is sooner and more easie gotten by Practice than by Precept) the following direction or General Rule will infallibly point out the Divisor.

GENERAL RULE.

If the Number required be greater than the Number given of the same Denomination, the lesser Number of the other De-

trarily, if the Number required be less than the Num-ber given of the same Denomination, the greater Num-ber of the other Denomination must be the Divisor.

The Golden Rule.

As for Example.

Supposing 6 *Pioners make a Trench in* 9 *daies*;
It is demanded *How many Pioners will make it in 3 daies?*

Where first, the Three Given Numbers being placed according to their Denominations, thus,	*Pioners.*	*Daies.*
	6	9
		3

It is presently evident that the Number Required is of Pioners. And seeing the work is to be done in less time or fewer days, it is easie to conclude that the number of the Workmen must be encreased, and consequently that the Number required (which is of Workmen or Pioners) must be greater than the Number given of the same Denomination, namely then 6 Pioners.

Wherefore (by the General Rule) the lesser Number of the other Denomination, or of Days, namely 3 must be the Divisor. Dividing therefore the product of the other two Numbers 6 and 9 (which is 54) by 3, the quotient, namely 18 will be the number of Pioners required. And in like manner, if the Question had been

How many Pioners will make the Trench in 18 days?
It had been as easie from consideration of the encrease of Time, to conclude, that fewer Workmen, or a less number of Pioners will do it; and that therefore (by the General Rule) the greater number of the other Denomination, or of Days, namely 18 must now be the Divisor; and the quotient 3 the Number of the Pioners that will make the Trench in the time propounded of 18 days.

And this one Example is sufficient to shew how to resolve all such Propositions as are to be wrought by the *Single Golden Rule*, namely all such Propositions as have but two Denominations and three Numbers given.

BUt many Propositions which are to be resolved by the *Golden Rule*, consist of three Denominations and five given Numbers; two of which denominations have each

Nevertheless the *Golden Rule* is still a Rule of Three. For every such Proposition is either to be resolved by two operations, or else the Five numbers are to be reduced to Three, that it may be done by one operation. From which two ways of working, this Rule is sometimes called the *Double Golden Rule*, or *Double Rule of Three*; and sometimes the *Compound Golden Rule*, or *Compound Rule of Three*; that is to say, the *Double Rule*, when the Proposition is resolved by two Operations, or by two Quotients; and the *Compound Rule*, when it is done by one Operation, or by one Quotient.

In working by either of these two ways, it is best (as was done above) to order the Numbers by their Denominations; namely, by putting that Denomination in the first place which has but one Number affixed, and the other two as they lie in the Proposition; and under every Denomination to set the Numbers belonging to it.

And first, In working by the *Double Rule*, take the three numbers of the first two Denominations, and by them find a fourth; then with this fourth, and the two of the last Denomination find another fourth; and this last fourth number will answer to the Question propounded.

For Example.

Suppos. *If 6 Pioners make 18 yards of Trench in 9 Days;*
Quest. *How many Pioners will make 36 yards in 3 Days?*

In the resolving of which proposition, I first order the Numbers by their Denominations, thus,

Pioners.	*Yards.*	*Days.*
6	18	9
	36	3

Then I take the 6 Pioners, and the 18 Yards, and the 36 yards, and say,

If 6 Pioners make 18 yards of Trench;
How many Pioners will make 36 yards?

Where it is presently manifest that I must have a greater number of Pioners; and therefore (by the General Rule) I take the lesser number of the other Denomination, or of yards, namely, 18 for my Divisor. By which dividing 216 (the product of the other two Numbers 36 and 6) the Quotient, namely, 12 is the first Number required of Pioners. Wherefore bringing this number of 12 Pioners to the two remaining numbers of Days, I say again,

How many Pioners will do the same in 3 days?

And because the time is lessened, I presently conclud[e] that the Number of Workmen must be encreased; that i[s] to say, I must yet have a greater number of Pioners; an[d] therefore (by the General Rule) the lesser number of th[e] other Denomination, or of Days, namely 3 must be m[y] Divisor. Dividing therefore the product of the othe[r] two numbers 9 and 12; (which is 108) by 3; the Quoti[ent,] namely 36 is my second number required of Pioners and answers to the Question propounded.

In working by the *Compound Rule*, First (by the Genera[l] Rule), seek out the two Divisors, and compound the[m] into one Divisor by multiplying them together. The[n] multiply together the other two numbers of the same De[-]nominations; and so the Five numbers will be reduced t[o] Three. Seeing therefore you know by this Reductio[n] which of the three numbers is your Divisor, divide by i[t] the product of the other two, and the quotient will be th[e] number required.

For Example.

I take again the last Proposition; and considering th[e] three numbers of the first and second Denominations (a[s] before) I find, that if 6 Pioners make 18 yards of Trench, I must have more Pioners to make 36 yards; and there[-]fore (following my General Rule) I take the lesser num[-]ber of yards, namely 18 for my first Divisor. And con[-]sidering again the three numbers of the first and third De[-]nominations, I finde also, that if 6 Pioners do it in 9 days, I must have more Pioners to do it in 3 days; and therefore I take (by the same General Rule) the lesser number of days for my second Divisor. Then multiply[-]ing these two Divisors together, of their product 54 I make one compounded Divisor. Also multiplying toge[-]ther the other two numbers of the same Denominations, I have for their product 324. And so the Five given num[-]bers are reduced to three; which ordered according to their Denominations, will now stand thus.

Pioners.	*Yards & Days.*	
6	54	
	324	

But 54 is my Divisor. Wherefore multiplying 324 by 6, and dividing the product 1944 by 54, I have for the quo[-]tient 36, which here by this one Rule of Three (as befor[e]) by

A

by two times) answers to the Question propounded.

NOTE 1.

Betwixt these two ways of working there is but this small difference, that the former consists of two Multiplications and two Divisions, & the latter of three Multiplications and one Division. But it is best for Learners to begin with the *Double Rule*, that afterwards when they come to use the *Compound Rule* they may be able readily to find out the two Divisors, which are to be compounded into one Divisor.

NOTE 2.

These two Divisors are always of those two Denominations which contain each of them two Numbers. If therefore the other two Numbers of the same Denominations be multiplied together, the compounded Divisor and this other compounded Number will be of one and the same mixt or compounded Denomination. Wherefore I thought it the best order to make this other compounded Number consist of the same Denominations with the compounded Divisor. Nevertheless it is not necessary to observe this order. For when any three Numbers are to be multiplied together, it is no matter which two are taken for the first multiplication; because which soever of them be first or last multiplied, the last or solid product will always be the same.

NOTE 3.

Whereas in working by the *Double Rule* I did for the finding out of the second Divisor apply the quotient of the first Division, namely 12 to the two numbers of the last Denomination; I might as well for that purpose have applied 6 or any other number: for the application of any number whatsoever would as certainly have pointed out that second Divisor. But I used that number 12 because it was as much at hand as any other; and because it was the onely determined Number by which I was to multiply the remaining number of the last Denomination, to make the product such, as being divided by 3 might give me for quotient the true number which answers to the Question, namely the number 36. So likewise in working by the *Compound Rule*, (where the number 12 came not at all in my way) I did for the finding out of the second Divisor apply 6 to the two Numbers of the last Denomination; not because it was necessary so to do (for any other Number might have served as well) but because it was next at

Note 4.

In every Proposition, the Question may be varied as many ways as there be Denominations in the Supposition. As in the first Example, where the Question is, *How many Pioners*, &c. It might have been *In how many Days*, &c. And in the second Example, where the Question is again, *How many Pioners*, &c. it might have been *How many Lands*, or *In how many Days*, &c. So also upon this supposition.

If 4612 Pounds serve to pay 5765 Souldiers for 24 days,

These three, or any like these three Questions may be propounded, namely,

1 Qu. *How many Pounds will pay 12875 Souldiers for 36 Days ?*

2 Qu. *How many Souldiers will 20000 Pounds pay for 40 Days ?*

3 Qu. *For how many Days will 25000 Pounds pay 10000 Souldiers ?*

Of which Supposition and several Questions, the Numbers ordered according to their Denominations, will stand thus :

First Question.			*Second Question.*			*Third Question.*		
Pounds.	*Sold.*	*Da.*	*Sold.*	*Pounds.*	*Da.*	*Da.*	*Pounds.*	*Sold.*
4612.	5765.	24.	5765.	4612.	24.	24.	4612.	5765.
	12875.	36.		20000.	40.		25000.	10000.

And reduced severally to three Numbers, that they may be wrought by the *Compound Rule*, they will stand thus.

First Question.		*Second Question.*		*Third Question.*	
Poun.	*Sol. & Da.*	*Sol.*	*Poun. & Da.*	*Da.*	*Poun. & Sol.*
4612.	138360	5765.	184480	24.	46120000
	463500		480000.		144125000.

By which Reduction the several Divisors being found to be

Sold. & Days.	*Pounds & Days.*	*Pounds & Souldiers.*
1 *Divis.* 138360.	2 *Divis.* 184480.	3 *Divis.* 46120000.

And the several products of the other two Numbers being severally divided by them, the Quotients, or Fourth Numbers will be

Pounds.	*Souldiers.*	*Days.*
1 *Quotient* 15450.	2 *Quotient* 15000.	3 *Quotient* 75.

which answer to the three Questions.

And now, setting every Divisor first, and Quotient last, I place the four Numbers belonging to every Operation, in the following order.

Sold.

[illegible]	[illegible]	[illegible]	[illegible]
Pounds & Da.	*Pounds & Da.*	*Souldiers.*	[illegible]
181440.	48000.	5765.	[illegible]
Pounds & Sold.	*Pounds & Sold.*	*Days.*	*Days.*
16128000.	161125000.	24.	[illegible]

Of which order I shall give the Reason in that which I have yet to say of this Rule by another appellation.

BEsides the names of *Golden Rule* & *Rule of Three*, this Rule has yet another name, being also called the RULE OF PROPORTION; because what proportion soever the Divisor has to either of the other two known Numbers, the same proportion will the remaining known Number have to the number required. And (when this is found) if all the four Numbers be set in such order, that either the two which multiply one another be first and last, or the Divisor and Quotient be first and last, those four Numbers will be Proportional.

For seeing the multiplication of the Quotient by the Divisor, produces always a Number equal to the Number divided; therefore 18 & 3, the Quotient and Divisor in the first Example being multiplied together, their product is equal to the number there divided: But that divided number is the product of 9 multiplied by 6. If therefore those four Numbers 18 & 3, 9 & 6 be set in such order, that either of the multiplying payrs be Extreams, and the other payr be Means (as 3. 9 :: 6. 18) they will (by the 19th Proposition of the 7th of Euclides Elements) be Proportional.

So in the Example of the *Double Rule*, the four Numbers after the first Operation, namely, 18. 36 :: 6. 12. and the four after the second Operation, namely, 80 :: 12. 36. as also the four Numbers of the same Example wrought by the *Compound Rule*, namely, 54. 324 :: 6. 36 are (by the same 19th Proposition of the 7th Element) *Proportional*: that is to say, the proportion of either of the Extreams to either of the Means is the same with that of the other Mean to the other Extream; and contrarily. Wherefore in every one of those orders of Numbers, it is, as the first to the second, so the third to the fourth. And this is the reason why after the working of the last Example I set the four Numbers of every Question in such order.

So also, in working the first Example by the *Compound Rule*,

[illegible] compounded Divisor 54, I had multiplied the first and second of the three remaining numbers together, namely 6 & 36, their product 216 and the third number 9 might have stood for Means; and their product 1944 divided by 54 would have given for Quotient (as before) 36. And in like manner, If I had multiplied together the first and third, namely 6 & 9, their product 54 and the other number 36, might have been Means, and their product, which is still 1944 divided by 54, would still have given for the fourth proportional or required number the same 36. In either of these two cases therefore the four Numbers, namely 54. 216 :: 9. 36. or 54. 54 :: 36. 36. would have been Proportional, but the Order and Analogy of the Denominations would have been more obscure. For whereas they were

Yards & Days.	*Yards & Days.*		*Pioners.*	*Pioners.*
54.	324	::	6.	36.

that is to say, as Yards and Days to Yards and Days, so Pioners to Pioners; they would here have been—

Yards & Days.	*Yards & Pioners.*		*Days.*	*Pioners.*
54.	216.	::	9.	36.

or

Yards & Days.	*Pioners & Days.*		*Yards.*	*Pioners.*
54.	54.	::	36.	36

That is to say, as Yards and Days to Yards and Pioners, so Days to Pioners; or, as Yards and Days to Pioners and Days, so Yards to Pioners; where the Analogy of the Denominations (though true) is not so easily discerned.

To conclude; That which by the 19th Proposition of the 7th Element is shewn in Numbers, is the same with that which by the 16th Proposition of the 6th Element is demonstrated in Lines. For there it is proved, That the four sides of any two equal equiangled parallelogrammes are proportional. And by the 14th Proposition of the same 6th Element it is proved, that their sides are in reciprocal proportion. So that when the four numbers of any proportion resolved are set in the order above-mentioned, the first and last of them will represent two sides of one of those equal parallelogrammes, and the two middle Numbers the two sides of the other. From whence it is easie to conclude, That of the Three known Numbers two represent the two sides of the one, and the third one side of the other parallelogramme. And seeing those parallelogrammes have their sides in reciprocal proportion, it is likewise easie to conclude, That the third Number which represents that one side must be the Divi-

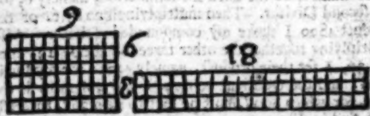
for;

that which represents the other side.

For Example.

If the Three known Numbers (as in the first Example) be $\left\{\begin{matrix} 6.\ 9 \\ 2 \quad 3 \end{matrix}\right\}$ and 3 be the Divisor; Let a rectangled parallelogramme be made, having 6 measures for one side, and 9 of the same measures for the other side.

If now another rectangled parallelogramme, having for one side 3 of those measures be made equal to the former, the other side will be found to consist of 18 of the same measures. But 3.9 :: 6. 18. are already shewn to be Proportional. And by shewing the parallelogrammes, the reciprocal proportion of their sides will sufficiently be shewn.



POSTSCRIPT.

I do not see how the Work either of the *Single* or of the *Double Golden Rule* can be made easier or shorter than I have made it. Nor can the *Compound Rule* be done by fewer workings of the Numbers. Nevertheless, because many may think it a tedious and troublesome thing to be tied to the terms of Proportion, and to observe the Denominations further than is necessary; I have for their sakes thought fit to reduce the *Compound Rule* to this short

Rule of Practise.

From the five given Numbers separate (by the General Rule) the two Divisors, and compound them into one Divisor. Then multiply together the three remaining Numbers; and of their solid product make the Dividend. The Quotient will be the Number required.

As

As for Example.

Sup. *If* 100 l. *lent gain* 6 l. *Interest in* 12 *Months;*
Quest. *In how many Months shall* 800 l. *lent, gain* 36 l. *Interest?*

The Question here being placed upon the last of the three Denominations in the Supposition, I set the number belonging to it, namely 12 in the first place; and the two Payrs of Numbers belonging to the other two Denominations, after it, thus,

Months.	*Principal.*	*Interest.*
12	100	6
	800	36

Then I say, If in 12 months 100 *l.* gain a sum of money, 800 *l.* will gain the same sum in less time. Wherefore (by the General Rule) I take 800 (the greatest Number of the second Denomination) for my first Divisor; and say again, If in 12 months I gain 6 *l.* I must have more time to gain 36 *l.* and therefore I take the lesser number of the third Denomination, namely 6, for my second Divisor. Then multiplying 800 by 6. of the product 4800 I make my compounded Divisor. Also multiplying together the other three Numbers, 12, 100, and 36, I set their product, namely 43200 for my Dividend; and the Quotient being 9, I say 9 months is the time, for which 800 *l.* must be lent, to gain 36 *l.* Interest.

" And in like manner, if a Proposition contain 4 or
" 5 Denominations, and 7 or 9 Numbers, all the Divi-
" sors are (by the General Rule) to be separated and
" compounded into one Divisor, and the remaining
" Numbers to be multiplied together into one Divi-
" dend.

" I will conclude all with an Example of five Denomi-
" nations.

" Sup. *If in* 9 *Days* 6 *Pioners make a Trench* 18 *yards long,* 6 *yards broad, and* 3 *yards deep;*
" Quest. *In how many Days will* 36 *Pioners make a Trench* 81 *yards long,* 9 *yards broad, and* 6 *yards deep?*

" The Question here being placed upon the first of
" the five Denominations in the Supposition, I set the
" Number belonging to it, namely 9 in the first place,
" and the four payrs of Numbers belonging to the
" other four Denominations after it, thus;

Days.	*Pioners.*	*Length.*	*Breadth.*	*Depth.*
9	6	18	6	3
	36	81	9	6, and say

If

[illegible]
"(by the General Rule) the greater Number, namely
"36 for my first Divisor; and say again, If a piece of
"work 18 yards long be 9 days a doing, 81 yards of the
"same work will take longer time, and therefore I take
"the less Number 18 for my second Divisor; and say
"further, If 6 yards of bredth require 9 days, 9 yards
"of the same bredth will require more days, and there-
"fore I take the less Number 6 for my third Divisor;
"and say lastly, If 3 yards of depth must have 9 days,
"6 yards of the same depth will require more days, and
"therefore I take the less Number 3 for my last Divi-
"sor; and multiplying these four Divisors together, I
"make my compounded Divisor of their product, 11664.
"Then multiplying together the other five Numbers
"their product, namely 236196 will be the compounded
"Dividend, and the Quotient 20 $\frac{1}{4}$ will answer to the
"Question, and give the Number of days in which 36
"Pioners will make a Trench 81 yards long, 9 yards
"broad, and 6 yards deep.

FINIS.

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